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PUB-NO: JP405176656A
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TITLE: RODLIKE REINFORCING ELASTIC BODY

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INVENTOR-INFORMATION:

NAME	COUNTRY
MORITA, TETSUO	
SAKURAOKA, MAKOTO	

ASSIGNEE-INFORMATION:

NAME	COUNTRY
SUMITOMO RUBBER IND LTD	N/A

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ABSTRACT:

PURPOSE: To obtain the subject elastic body, having a high, flexural rigidity, excellent in corrosion, weather and water resistance and useful as a crawl frame, a pier, etc., by embedding plural core materials composed of fiber-reinforced plastic rods in a bonded state in the axial direction in a rodlike rubber.

CONSTITUTION: The objective elastic body is obtained by embedding plural core materials composed of fiber-reinforced plastic (FRP) rods 2 in a mutually bonded state in the axial direction in a rubber rod 1 which is a base material.

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E02B	3/06		7150－2D		
E04C	3/36		8504－2E		
E04H	12/02		9128－2E		

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(71)出願人　000183233
住友ゴム工業株式会社
兵庫県神戸市中央区筒井町1丁目1番1号

(72)発明者　森田　徹男
大阪市阿倍野区松崎町4－11－3

(72)発明者　桜岡　誠
兵庫県神戸市垂水区南多聞台4丁目9番5号

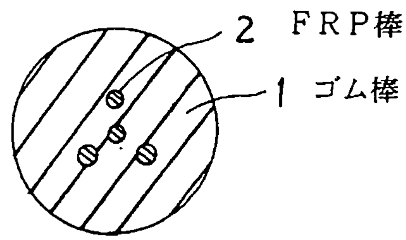
(74)代理人　弁理士　渡邊　隆文　（外2名）

(54)【発明の名称】　棒状補強弾性体

(57)【要約】

【目的】　径の大きいＦＲＰ棒と同等の曲げ剛性を得、しかも径の大きいＦＲＰ棒よりも曲げに対する許容変形度も大きくなる棒状補強弾性体を提供する。

【構成】　母材であるゴム棒１中に、複数のＦＲＰ棒２からなる芯材を、軸方向に沿って互いに接着させた状態で埋設する。



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【特許請求の範囲】

【請求項1】母材である棒状のゴム中に、複数の棒状の繊維強化プラスチックからなる芯材を、軸方向に沿って互いに接着した状態で埋設したことを特徴とする棒状補強弾性体。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、曲げ変形に対しての剛性が大きく、かつ曲げの許容限度が大きいことが要求されるイケス枠、桟橋、旗や鯉のぼり用のポール等に使用される棒状補強弾性体に関する。

【0002】

【従来の技術】従来より、イケス枠、桟橋、旗や鯉のぼり用のポール等には、曲げ変形に対しての剛性が大きく、かつ破壊作用に対して変形で対応できるよう曲げの許容限度が大きいことが要求されるため、竹、木材、プラスチック、繊維強化プラスチック（以下、ＦＲＰ(Fiber Reinforced Plastics) という）等が使用されていた。

【0003】

【発明が解決しようとする課題】上記既存の部材の問題点を以下に示す。

（１）竹および木材

竹や木材は、産地により材質が異なったり、あるいは産地が同じであっても個々に材質が微妙に異なるため、同じ材質のものを揃えるのが困難となっていた。また、１０m以上の長さの竹や木材は少ないため、長さに制限を受ける。特に、竹の場合、根元と先端で太さが違うため、使用範囲が限定されていると共に、節があるので、全体としての剛性が高まるものの、節の箇所と筒の箇所とでの剛性が異なり、一様でない。そのため、１か所に傷ができると、傷が軸方向に成長し割れてしまう。さらに、竹や木材は、水中あるいは土中等で長期に使用すると、腐食する。

（２）プラスチック、ＦＲＰ

プラスチック、ＦＲＰでは、曲げ剛性を大きくするには、高価な補強繊維を用いなけらばならない。あるいは、断面２次モーメントを大きくするためには、太い径のものを用いなければならない。太い径のものを用いると、曲げ剛性は大きくなるが、曲げ許容限度が小さくなるばかりか、価格も高くなる。プラスチック、ＦＲＰには、パイプ形状のものもあるが、パイプ形状のものは曲げ変形時の座屈の問題がある。さらに、耐候性に問題を生じる場合もある。

【0004】また、プラスチック、ＦＲＰについては、複数の棒状のプラスチック、ＦＲＰを接着によって一体化して複合化すると、その本数以上の曲げ剛性が得られることが知られている。例えば、３本のプラスチック、ＦＲＰを一体化せず、単に束ねただけでは、その曲げ剛性が単に断面２次モーメントが３倍になるだけで、３倍

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変形しにくくなる。つまり、３倍強く、かつ３倍の曲げ剛性となるだけで、ある程度の変形を必要とするイケス枠、桟橋、旗や鯉のぼり用のポール等に使用するメリットはない。これに対し、上述のように、３本のプラスチック、ＦＲＰに母材（マトリクス）を介在させて、３本のプラスチック、ＦＲＰを接着により一体化して１本として変形するようにすると、その断面２次モーメントは１本のプラスチック、ＦＲＰの場合の断面２次モーメントの１１倍となり、単に３本束ねただけのときと比べて、曲げ剛性で１１÷３＝３．６７倍の複合化、一体化の効果が得られる。

【0005】しかし、上記の例では、断面積の大きな、すなわち太い径のプラスチック、ＦＲＰを１本用いる場合と比べると、その曲げ許容限度は著しく小さくなってしまう。また、この例では、プラスチック、ＦＲＰとマトリクスとの接着強さと、マトリクスの同等か、あるいはそれ以上の破壊強さが必要である。本発明は、上記に鑑み、断面２次モーメントの大きい、すなわち径の大きいＦＲＰ棒と同等の曲げ剛性を得、しかも径の大きいＦＲＰ棒よりも曲げに対する許容限度も大きくなる棒状補強弾性体の提供を目的とする。

【0006】

【課題を解決するための手段】本発明による課題解決手段は、母材である棒状のゴム中に、複数の棒状の繊維強化プラスチックからなる芯材を、軸方向に沿って互いに接着した状態で埋設したものである。

【0007】

【作用】上記課題解決手段において、母材である棒状のゴム中に、棒状の繊維強化プラスチックからなる芯材を、軸方向に沿って互いに接着した状態で埋設しているから、曲げ剛性が強くなるといったゴム棒と繊維強化プラスチック棒との複合化の効果が得られる。また、ゴム棒と繊維強化プラスチック棒との複合化のメリットに加えて、断面２次モーメントの大きい、すなわち径の大きい維強化プラスチック棒と同等の曲げ剛性を得、しかも径の大きい維強化プラスチック棒よりも曲げに対する許容限度も大きくなる。

【0008】

【実施例】以下、本発明の一実施例を図１に基づいて説明する。図１は本発明の一実施例に係る棒状補強弾性体の断面図である。本実施例の棒状補強弾性体は、母材（マトリクス）であるゴム棒１中に、接着処理を施した４本の繊維強化プラスチック（以下、ＦＲＰ(Fiber Reinforced Plastics) という）棒２からなる芯材（コア）を、軸方向に沿って互いに接着した状態で埋設して、ゴム棒１とＦＲＰ棒２とを一体化したものである。

【0009】上記ゴム棒１は、破壊に対して変形で対抗できるよう許容変形量が大きく、またＦＲＰ棒２との接着強さが大きいものが使用されており、その径はφ３０mm、曲げ剛性は２７０００ｋｇｍｍ^2 である。上記Ｆ

ＲＰ棒２は、例えば不飽和ポリエステル／ガラス繊維の引き抜き成形品であり、その径はφ３ｍｍ、曲げ剛性は１７０００ｋｇｍｍ^2 である。

【００１０】そして、本出願人は、上記実施例と、ＦＲＰ棒４本をゴムと非接着の状態で挿入した場合（以下、比較例という）との曲げ剛性を比較検討した。この結果、比較例の曲げ剛性は９５０００ｋｇｍｍ^2 となり、単にＦＲＰ棒４本分の曲げ剛性（１７０００ｋｇｍｍ^2 ×４）とゴム分の曲げ剛性（２７０００ｋｇｍｍ^2 ）とを加算した値となるにすぎず、何ら力学的メリットはないことが判明した。これに対し、実施例の曲げ剛性は４１３０００ｋｇｍｍ^2 となる。この値は、比較例の約４．３倍（４１３０００ｋｇｍｍ^2 ／９５０００ｋｇｍｍ^2 ）であり、複合化の効果が現れることが判明した。

【００１１】次に、実施例の曲げ剛性と、断面２次モーメントの大きい、すなわちφ７ｍｍと径の大きいＦＲＰ棒１本の曲げ剛性との比較を行った。この結果、φ７ｍｍのＦＲＰ棒１本の曲げ剛性は３８５０００ｋｇｍｍ^2 であり、実施例の構成にすれば、φ７ｍｍのＦＲＰ棒の曲げ剛性と同等以上の曲げ剛性を得ることができることも明らかとなった。

【００１２】さらに、ここで上記実施例とφ７ｍｍのＦＲＰ棒１本との曲げ破壊が生じる最小曲げ半径を考察すると、φ７ｍｍのＦＲＰ棒の最小曲げ半径ｒ＝２０４ｍｍに対し、実施例で使用されたたφ３ｍｍのＦＲＰ棒の最小曲げ半径ｒ＝７７ｍｍであり、φ３ｍｍのＦＲＰ棒を４本をゴムを母材として一体化した実施例は、少なくとも曲げ半径ｒ＝２０４ｍｍになっても破壊（折れない）と推察される。つまり、実施例は、φ７ｍｍのＦＲＰ棒よりも曲げに対する許容限度が大きくなる。

【００１３】すなわち、本実施例の棒状補強弾性体は、マトリクスであるゴム棒１中に、コアである接着処理を施したＦＲＰ棒２を、軸方向に沿って互いに接着した状態で埋設しているから、単にＦＲＰ棒を４本束ねただけの場合と比べて曲げ剛性が強くなるといったゴム棒１とＦＲＰ棒２との複合化の効果が得られる。また、この複合化のメリットに加えて、断面２次モーメントの大きい、すなわち径の大きいＦＲＰ棒と同等の曲げ剛性を得、しかも径の大きいＦＲＰ棒よりも曲げに対する許容限度も大きくすることができる。よって、この棒状補強弾性体は、曲げ変形に対しての剛性が大きく、かつ曲げの許容限度が大きいことが要求されるイケス枠、桟橋、旗や鯉のぼり用のポール等の使用に最適となる。

【００１４】なお、本発明は上記実施例に限定されるものではなく、本発明の範囲で上記実施例に多くの修正および変更を加え得ることは勿論である。例えば、上記実施例では４本のＦＲＰ棒を使用した例について記載したが、棒状補強弾性体として等方性が必要な場合には、図２（ａ）（ｂ）のように、例えば３本あるいは７本のＦＲＰ棒を断面方向に対して対称の位置に配置すればよい。また、棒状補強弾性体として異方性が要求される場合には、２本のＦＲＰ棒を使用するなら、図３（ａ）において２本のＦＲＰ棒を縦方向に並べるか横方向にならべるかで剛性が異なり、あるいは図３（ｂ）のように、３本のＦＲＰ棒を一列に並べた形で配置すれば、より顕著にその効果が現れる。このように、ＦＲＰ棒の本数、配列を変えるだけで、要求される曲げ剛性、曲げの許容限度に応じた自由な設計が可能となり、また長さ、太さも自由に設計できる。

【００１５】また、使用するゴムの材料選択、またゴム部分を補強繊維で補強すれば、耐腐食性、耐候性、耐水性等の耐久性能に優れたものも設計できる。

【００１６】

【発明の効果】以上の説明から明らかな通り、本発明の棒状補強弾性体によると、曲げ剛性が強くなるといったゴム棒と繊維強化プラスチック棒との複合化の効果が得られる。また、ゴム棒と繊維強化プラスチック棒との複合化のメリットに加えて、断面２次モーメントの大きい、すなわち径の大きい繊維強化プラスチック棒と同等の曲げ剛性を得、しかも径の大きい繊維強化プラスチック棒よりも曲げに対する許容限度も大きくすることができる。よって、曲げ変形に対しての剛性が大きく、かつ曲げの許容限度が大きいことが要求されるイケス枠、桟橋、旗や鯉のぼり用のポール等の使用に最適となるといった優れた効果がある。

【００１７】また、繊維強化プラスチック棒の本数、配列を変えるだけで、要求される曲げ剛性、曲げの許容変形度に応じた自由な設計が可能となり、また長さ、太さも自由に設計でき、使用するゴムの材料選択、またゴム部分を補強繊維で補強すれば、耐腐食性、耐候性、耐水性等の耐久性能に優れたものも設計できる。

【図面の簡単な説明】

【図１】本発明の一実施例に係る棒状補強弾性体の断面図である。

【図２】他の実施例に係る棒状補強弾性体の断面図である。

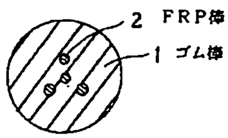
【図３】他の実施例に係る棒状補強弾性体の断面図である。

【符号の説明】

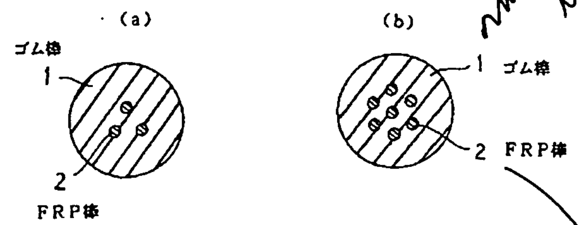
１　ゴム棒

２　ＦＲＰ棒

【図1】



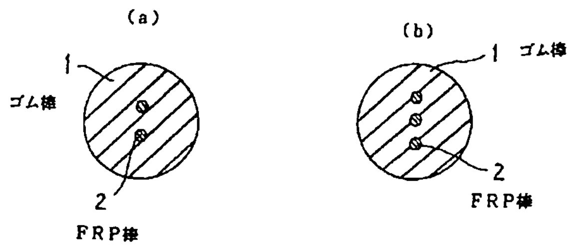
【図2】



rubber rod

fiber reinforced plastic

【図3】



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E04H 12/32		9128－2E		

* NOTICES *

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] It is related with the cylindrical reinforcement elastic body used for the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that the rigidity of this invention over bending deformation is large, and the tolerance limit of bending is large.
[0002]
[Description of the Prior Art] Before, since it was required that the rigidity over bending deformation should be large, and the tolerance limit bent so that it can respond by deformation to a destructive operation should be large, a bamboo, wood, plastics, fiber reinforced plastics (henceforth FRP (Fiber Reinforced Plastics)), etc. were used for the pole for an IKESU frame, a pier, a flag, or carp streamers.
[0003]
[Problem(s) to be Solved by the Invention] The trouble of the above-mentioned existing member is shown below.
(1) Since the quality of the material changed with places of production, or the quality of the materials differed delicately separately even if a place of production is the same, a bamboo and a wood bamboo, and wood were difficult to arrange the thing of the same quality of the material. Moreover, since there are little the bamboo and wood 10m or more of length, they receive a limit in length. Although the rigidity as the whole increases since there is a knot while the use range is limited since a size is different at a root and the tip especially in the case of a bamboo, the rigidity in the part of a knot and the part of a cylinder differs, and it is not uniform. Therefore, a blemish will be grown and divided into shaft orientations if a blemish is made to one place. Furthermore, a bamboo and wood will be corroded if it is used for a long period of time by underwater or the soil middle class.
(2) in order to enlarge flexural rigidity in plastics, FRP plastics, and FRP, expensive reinforcement fiber is used -- if it kicks, it will not become. Or in order to enlarge a cross-section second moment, the thing of a thick path must be used. Although flexural rigidity will become large if the thing of a thick path is used, about [that a bending tolerance limit becomes small] and a price also becomes high. Although there is also a thing of a pipe configuration in plastics and FRP, the thing of a pipe configuration has the problem of the buckling at the time of bending deformation. Furthermore, a problem may be produced in weatherability.
[0004] Moreover, about plastics and FRP, if the plastics of the shape of two or more rod and FRP are unified and compound-ized by adhesion, it is known that the flexural rigidity more than the number will be acquired. For example, a cross-section second moment stops easily being able to deform only by increasing 3 times only by having not unified but bundling three plastics and FRP for the flexural rigidity 3 times. That is, it is 3 times stronger and there is no merit used for the IKESU frame which needs a certain amount of deformation, a pier, a flag, the pole for carp streamers, etc. only by becoming one 3 times the flexural rigidity of this. On the other hand, if a base material (matrix) is made placed between three plastics and FRP, three plastics and FRP are unified by adhesion as mentioned above and it is made to deform as one The cross-section second moment will be one plastics and 11 times the

cross-section second moment in the case of FRP, and the effect of compound-izing of 11/3=3.67 time and unification is acquired with flexural rigidity compared with the time only of having only only bundled three.

[0005] However, in the above-mentioned example, the bending tolerance limit will become remarkably small compared with the case where the plastics of a thick path and one FRP are used big [the cross section]. Moreover, the breaking strength beyond the bonding strength of plastics, FRP, and a matrix, the EQC of a matrix, or it is required of this example. In view of the above, this invention acquires flexural rigidity equivalent to the large FRP rod of a path greatly [a cross-section second moment], and aims at offer of the cylindrical reinforcement elastic body with which the tolerance limit over bending moreover also becomes large rather than the large FRP rod of a path.

[0006]

[Means for Solving the Problem] A technical-problem solution means by this invention lays underground a core material which consists of fiber reinforced plastics of the shape of two or more rod in the condition of having pasted up mutually in accordance with shaft orientations, into rubber of the shape of a rod which is a base material.

[0007]

[Function] In the above-mentioned technical-problem solution means, since the core material which consists of rod-like fiber reinforced plastics is laid underground in the condition of having pasted up mutually in accordance with shaft orientations, into the rubber of the shape of a rod which is a base material, the effect of compound-izing of the rubber rod and the fiber-reinforced-plastics rod that flexural rigidity becomes strong is acquired. Moreover, in addition to the merit of compound-izing of a rubber rod and a fiber-reinforced-plastics rod, flexural rigidity equivalent to the large ****** plastic bar of a path is acquired, and the tolerance limit over bending also becomes large rather than the large ****** plastic bar of a path greatly [a cross-section second moment].

[0008]

[Example] Hereafter, one example of this invention is explained based on drawing 1 . Drawing 1 is the cross section of the cylindrical reinforcement elastic body concerning one example of this invention. In the rubber rod 1 which is a base material (matrix), the cylindrical reinforcement elastic body of this example lays underground the core material (core) which consists of four fiber-reinforced-plastics (henceforth FRP (Fiber Reinforced Plastics)) rods 2 which performed adhesion processing in the condition of having pasted up mutually in accordance with shaft orientations, and unifies the rubber rod 1 and the FRP rod 2.

[0009] what has large bonding strength with the FRP rod 2 uses the above-mentioned rubber rod 1 greatly [permission deformation] so that it can oppose by deformation to destruction -- having -- **** -- the path -- phi30mm and flexural rigidity -- 27000kgmm(s)2 it is . the above-mentioned FRP rod 2 -- for example, the drawing mold goods of unsaturated polyester/glass fiber -- it is -- the path -- phi3mm and flexural rigidity -- 17000kgmm(s)2 it is .

[0010] And these people did comparison examination of the flexural rigidity of the above-mentioned example and the case (henceforth the example of a comparison) where it inserts in the state of rubber and un-pasting up up four FRP rods. Consequently, the flexural rigidity of the example of a comparison is 95000kgmm(s)2. It did not pass to become and become the value which only added the flexural rigidity (17000kgmm 2x4) of FRP rod 4 duty, and the flexural rigidity for rubber (27000kgmm2), but it became clear that there was no dynamic merit in any way. On the other hand, the flexural rigidity of an example is 413000kgmm(s)2. It becomes. This value is about 4.3 times (413000kgmm2 / 95000kgmm2) the example of a comparison, and it became clear that the effect of compound-izing showed up.

[0011] Next, the comparison with the flexural rigidity of an example, and phi7mm and the flexural rigidity of one large FRP rod of a path with a large namely, cross-section second moment was performed. consequently, the flexural rigidity of one phi7mm FRP rod -- 385000kgmm(s)2 it is -- when making it the configuration of an example, it also became clear that the flexural rigidity of a phi7mm FRP rod and the flexural rigidity more than equivalent can be acquired.

[0012] Furthermore, if the minimum bending radius which bending failure with an above-mentioned

example and one FRP rod of phi7mm produces here is considered It is r= 77mm in minimum bending radius of the ** phi3mm FRP rod used in the example to the minimum bending radius of r= 204mm of a phi7mm FRP rod. Even if the example which unified [the phi3mm FRP rod] rubber as a base material for four becomes bend radii of r= 204mm at least, it is imagined to be destruction (for it not to break). That is, as for an example, the tolerance limit over bending becomes large rather than a phi7mm FRP rod.

[0013] That is, since the cylindrical reinforcement elastic body of this example is laying underground the FRP rod 2 which performed adhesion processing which is a core in the condition pasted up mutually in accordance with shaft orientations, into the rubber rod 1 which is a matrix, the effect of compound-izing of the rubber rod 1 and the FRP rod 2 that flexural rigidity becomes strong compared with the case of having only bundled four FRP rods is acquired. Moreover, in addition to the merit of this compound-izing, flexural rigidity equivalent to the large FRP rod of a path can be acquired, and a cross-section second moment can also make the tolerance limit over bending greatly larger than the large FRP rod of a path. Therefore, it becomes the best for use of the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that this cylindrical reinforcement elastic body has the large rigidity over bending deformation, and the tolerance limit of bending is large.

[0014] In addition, as for this invention, it is needless to say that it is not limited to the above-mentioned example and many corrections and modification can be added to the above-mentioned example in the range of this invention. For example, what is necessary is just to arrange 3 or seven FRP rods in the location of symmetry to the direction of a cross section, as shown in drawing 2 (a) and (b) when isotropy is required as a cylindrical reinforcement elastic body although the above-mentioned example indicated the example which used four FRP rods. Moreover, if two FRP rods are used and it will arrange in the form where rigidity differed by the ability to rank [whether two FRP rods are arranged in a lengthwise direction in drawing 3 (a), or] with a longitudinal direction, or three FRP rods were arranged in the single tier like drawing 3 (b) when an anisotropy is required as a cylindrical reinforcement elastic body, the effect will show up more notably. Thus, only by changing the number of an FRP rod, and an array, the free layout according to the tolerance limit of the flexural rigidity demanded and bending is attained, and length and a size can also be designed freely.

[0015] Moreover, if material selection of the rubber to be used and a rubber portion are reinforced with reinforcement fiber, the thing excellent in endurance ability, such as corrosion resistance, weatherability, and a water resisting property, can also be designed.

[0016]

[Effect of the Invention] According to the cylindrical reinforcement elastic body of this invention a passage clear from the above explanation, the effect of compound-izing of the rubber rod and the fiber-reinforced-plastics rod that flexural rigidity becomes strong is acquired. Moreover, in addition to the merit of compound-izing of a rubber rod and a fiber-reinforced-plastics rod, flexural rigidity equivalent to the large fiber-reinforced-plastics rod of a path can be acquired, and a cross-section second moment can also make the tolerance limit over bending greatly larger than the large fiber-reinforced-plastics rod of a path. Therefore, there is an outstanding effect that it becomes the best for use of the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that the rigidity over bending deformation is large, and the tolerance limit of bending is large.

[0017] Moreover, only by changing the number of a fiber-reinforced-plastics rod, and an array, the free layout according to whenever [flexural rigidity / which is demanded / and bending's permissible deformation] is attained, and length and a size can also be designed freely, and if material selection of the rubber to be used and a rubber portion are reinforced with reinforcement fiber, the thing excellent in endurance ability, such as corrosion resistance, weatherability, and a water resisting property, can also be designed.

[Translation done.]

TECHNICAL FIELD

[Industrial Application] It is related with the cylindrical reinforcement elastic body used for the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that the rigidity of this invention over bending deformation is large, and the tolerance limit of bending is large.

[Translation done.]

PRIOR ART

[Description of the Prior Art] Before, since it was required that the rigidity over bending deformation should be large, and the tolerance limit bent so that it can respond by deformation to a destructive operation should be large, a bamboo, wood, plastics, fiber reinforced plastics (henceforth FRP (Fiber Reinforced Plastics)), etc. were used for the pole for an IKESU frame, a pier, a flag, or carp streamers.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention] According to the cylindrical reinforcement elastic body of this invention a passage clear from the above explanation, the effect of compound-izing of the rubber rod and the fiber-reinforced-plastics rod that flexural rigidity becomes strong is acquired. Moreover, in addition to the merit of compound-izing of a rubber rod and a fiber-reinforced-plastics rod, flexural rigidity equivalent to the large fiber-reinforced-plastics rod of a path can be acquired, and a cross-section second moment can also make the tolerance limit over bending greatly larger than the large fiber-reinforced-plastics rod of a path. Therefore, there is an outstanding effect that it becomes the best for use of the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that the rigidity over bending deformation is large, and the tolerance limit of bending is large.
[0017] Moreover, only by changing the number of a fiber-reinforced-plastics rod, and an array, the free layout according to whenever [flexural rigidity / which is demanded / and bending's permissible deformation] is attained, and length and a size can also be designed freely, and if material selection of the rubber to be used and a rubber portion are reinforced with reinforcement fiber, the thing excellent in endurance ability, such as corrosion resistance, weatherability, and a water resisting property, can also be designed.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] The trouble of the above-mentioned existing member is shown below.
(1) Since the quality of the material changed with places of production, or the quality of the materials differed delicately separately even if a place of production is the same, a bamboo and a wood bamboo, and wood were difficult to arrange the thing of the same quality of the material. Moreover, since there are little the bamboo and wood 10m or more of length, they receive a limit in length. Although the rigidity as the whole increases since there is a knot while the use range is limited since a size is different at a root and the tip especially in the case of a bamboo, the rigidity in the part of a knot and the part of a cylinder differs, and it is not uniform. Therefore, a blemish will be grown and divided into shaft orientations if a blemish is made to one place. Furthermore, a bamboo and wood will be corroded if it is used for a long period of time by underwater or the soil middle class.
(2) in order to enlarge flexural rigidity in plastics, FRP plastics, and FRP, expensive reinforcement fiber is used -- if it kicks, it will not become. Or in order to enlarge a cross-section second moment, the thing of a thick path must be used. Although flexural rigidity will become large if the thing of a thick path is used, about [that a bending tolerance limit becomes small] and a price also becomes high. Although there is also a thing of a pipe configuration in plastics and FRP, the thing of a pipe configuration has the problem of the buckling at the time of bending deformation. Furthermore, a problem may be produced in weatherability.
[0004] Moreover, about plastics and FRP, if the plastics of the shape of two or more rod and FRP are unified and compound-ized by adhesion, it is known that the flexural rigidity more than the number will be acquired. For example, a cross-section second moment stops easily being able to deform only by increasing 3 times only by having not unified but bundling three plastics and FRP for the flexural rigidity 3 times. That is, it is 3 times stronger and there is no merit used for the IKESU frame which needs a certain amount of deformation, a pier, a flag, the pole for carp streamers, etc. only by becoming one 3 times the flexural rigidity of this. On the other hand, if a base material (matrix) is made placed between three plastics and FRP, three plastics and FRP are unified by adhesion as mentioned above and it is made to deform as one The cross-section second moment will be one plastics and 11 times the cross-section second moment in the case of FRP, and the effect of compound-izing of 11/3=3.67 time and unification is acquired with flexural rigidity compared with the time only of having only only bundled three.
[0005] However, in the above-mentioned example, the bending tolerance limit will become remarkably small compared with the case where the plastics of a thick path and one FRP are used big [the cross section]. Moreover, the breaking strength beyond the bonding strength of plastics, FRP, and a matrix, the EQC of a matrix, or it is required of this example. In view of the above, this invention acquires flexural rigidity equivalent to the large FRP rod of a path greatly [a cross-section second moment], and aims at offer of the cylindrical reinforcement elastic body with which the tolerance limit over bending moreover also becomes large rather than the large FRP rod of a path.

[Translation done.]

MEANS

[Means for Solving the Problem] A technical-problem solution means by this invention lays underground a core material which consists of fiber reinforced plastics of the shape of two or more rod in the condition of having pasted up mutually in accordance with shaft orientations, into rubber of the shape of a rod which is a base material.

[Translation done.]

OPERATION

[Function] In the above-mentioned technical-problem solution means, since the core material which consists of rod-like fiber reinforced plastics is laid underground in the condition of having pasted up mutually in accordance with shaft orientations, into the rubber of the shape of a rod which is a base material, the effect of compound-izing of the rubber rod and the fiber-reinforced-plastics rod that flexural rigidity becomes strong is acquired. Moreover, in addition to the merit of compound-izing of a rubber rod and a fiber-reinforced-plastics rod, flexural rigidity equivalent to the large ****** plastic bar of a path is acquired, and the tolerance limit over bending also becomes large rather than the large ****** plastic bar of a path greatly [a cross-section second moment].

[Translation done.]

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EXAMPLE

[Example] Hereafter, one example of this invention is explained based on drawing 1 . Drawing 1 is the cross section of the cylindrical reinforcement elastic body concerning one example of this invention. In the rubber rod 1 which is a base material (matrix), the cylindrical reinforcement elastic body of this example lays underground the core material (core) which consists of four fiber-reinforced-plastics (henceforth FRP (Fiber Reinforced Plastics)) rods 2 which performed adhesion processing in the condition of having pasted up mutually in accordance with shaft orientations, and unifies the rubber rod 1 and the FRP rod 2.
[0009] what has large bonding strength with the FRP rod 2 uses the above-mentioned rubber rod 1 greatly [permission deformation] so that it can oppose by deformation to destruction -- having -- **** -- the path -- phi30mm and flexural rigidity -- 27000kgmm(s)2 it is . the above-mentioned FRP rod 2 -- for example, the drawing mold goods of unsaturated polyester/glass fiber -- it is -- the path -- phi3mm and flexural rigidity -- 17000kgmm(s)2 it is .
[0010] And these people did comparison examination of the flexural rigidity of the above-mentioned example and the case (henceforth the example of a comparison) where it inserts in the state of rubber and un-pasting up up four FRP rods. Consequently, the flexural rigidity of the example of a comparison is 95000kgmm(s)2. It did not pass to become and become the value which only added the flexural rigidity (17000kgmm 2x4) of FRP rod 4 duty, and the flexural rigidity for rubber (27000kgmm2), but it became clear that there was no dynamic merit in any way. On the other hand, the flexural rigidity of an example is 413000kgmm(s)2. It becomes. This value is about 4.3 times (413000kgmm2 / 95000kgmm2) the example of a comparison, and it became clear that the effect of compound-izing showed up.
[0011] Next, the comparison with the flexural rigidity of an example, and phi7mm and the flexural rigidity of one large FRP rod of a path with a large namely, cross-section second moment was performed. consequently, the flexural rigidity of one phi7mm FRP rod -- 385000kgmm(s)2 it is -- when making it the configuration of an example, it also became clear that the flexural rigidity of a phi7mm FRP rod and the flexural rigidity more than equivalent can be acquired.
[0012] Furthermore, if the minimum bending radius which bending failure with an above-mentioned example and one FRP rod of phi7mm produces here is considered It is r= 77mm in minimum bending radius of the ** phi3mm FRP rod used in the example to the minimum bending radius of r= 204mm of a phi7mm FRP rod. Even if the example which unified [the phi3mm FRP rod] rubber as a base material for four becomes bend radii of r= 204mm at least, it is imagined to be destruction (for it not to break). That is, as for an example, the tolerance limit over bending becomes large rather than a phi7mm FRP rod.
[0013] That is, since the cylindrical reinforcement elastic body of this example is laying underground the FRP rod 2 which performed adhesion processing which is a core in the condition pasted up mutually in accordance with shaft orientations, into the rubber rod 1 which is a matrix, the effect of compound-izing of the rubber rod 1 and the FRP rod 2 that flexural rigidity becomes strong compared with the case of having only bundled four FRP rods is acquired. Moreover, in addition to the merit of this compound-izing, flexural rigidity equivalent to the large FRP rod of a path can be acquired, and a cross-section

second moment can also make the tolerance limit over bending greatly larger than the large FRP rod of a path. Therefore, it becomes the best for use of the IKESU frame demanded, a pier, a flag, the pole for carp streamers, etc. that this cylindrical reinforcement elastic body has the large rigidity over bending deformation, and the tolerance limit of bending is large.

[0014] In addition, as for this invention, it is needless to say that it is not limited to the above-mentioned example and many corrections and modification can be added to the above-mentioned example in the range of this invention. For example, what is necessary is just to arrange 3 or seven FRP rods in the location of symmetry to the direction of a cross section, as shown in drawing 2 (a) and (b) when isotropy is required as a cylindrical reinforcement elastic body although the above-mentioned example indicated the example which used four FRP rods. Moreover, if two FRP rods are used and it will arrange in the form where rigidity differed by the ability to rank [whether two FRP rods are arranged in a lengthwise direction in drawing 3 (a), or] with a longitudinal direction, or three FRP rods were arranged in the single tier like drawing 3 (b) when an anisotropy is required as a cylindrical reinforcement elastic body, the effect will show up more notably. Thus, only by changing the number of an FRP rod, and an array, the free layout according to the tolerance limit of the flexural rigidity demanded and bending is attained, and length and a size can also be designed freely.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section of the cylindrical reinforcement elastic body concerning one example of this invention.
[Drawing 2] It is the cross section of the cylindrical reinforcement elastic body concerning other examples.
[Drawing 3] It is the cross section of the cylindrical reinforcement elastic body concerning other examples.
[Description of Notations]
1 Rubber Rod
2 FRP Rod

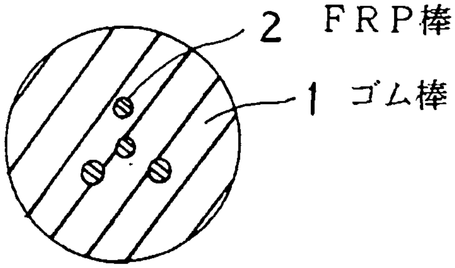
[Translation done.]

CLAIMS

[Claim(s)]
[Claim 1] A cylindrical reinforcement elastic body characterized by laying underground a core material which consists of fiber reinforced plastics of the shape of two or more rod in the condition of having pasted up mutually in accordance with shaft orientations, into rubber of the shape of a rod which is a base material.

[Translation done.]

Drawing selection Representative drawing



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